



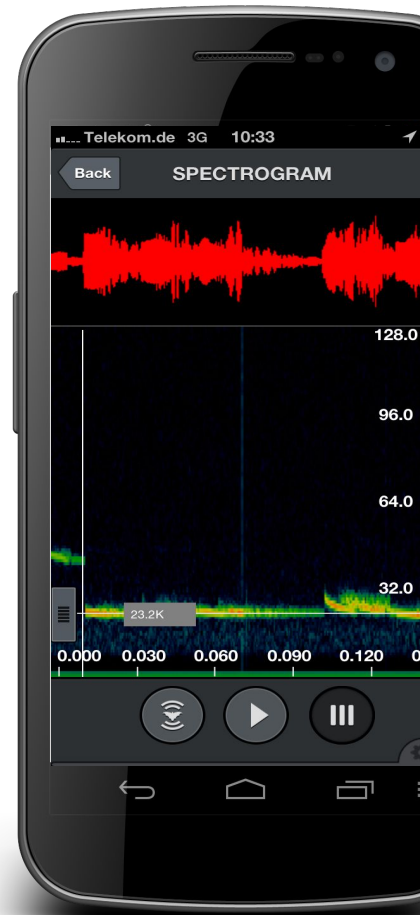
Think Global, Act Local ?

Research Infrastructures & SDG measurement



Ed Parsons

eparsons@google.com
@edparsons



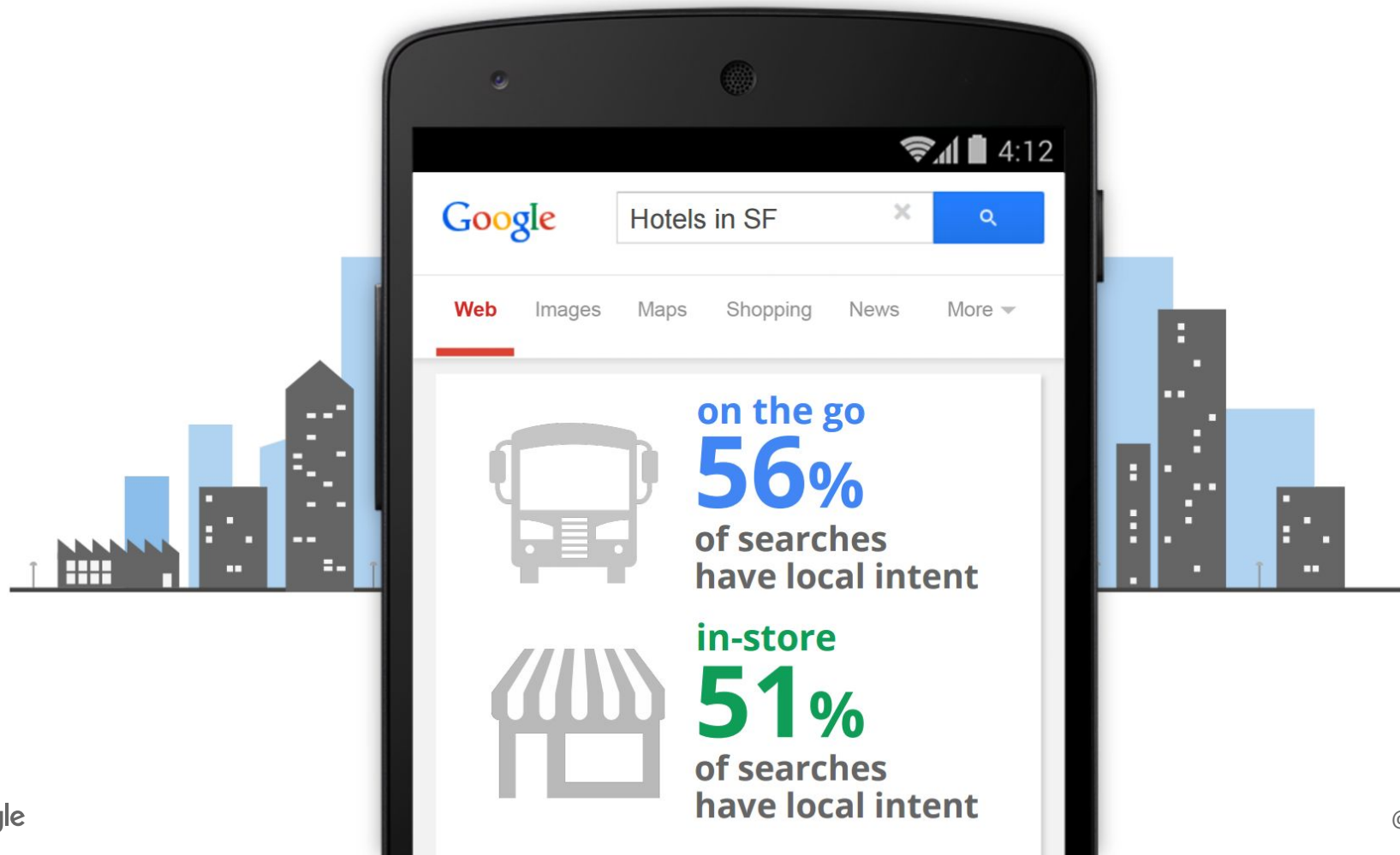


Geography



Google Search

I'm Feeling Lucky



Think globally, act locally.

Think globally, act locally.



Patrick Geddes, 1886

Think globally, act locally.

Think Locally, act globally.

The three ages of GIS



1995-2005



2005-2015



2015 +

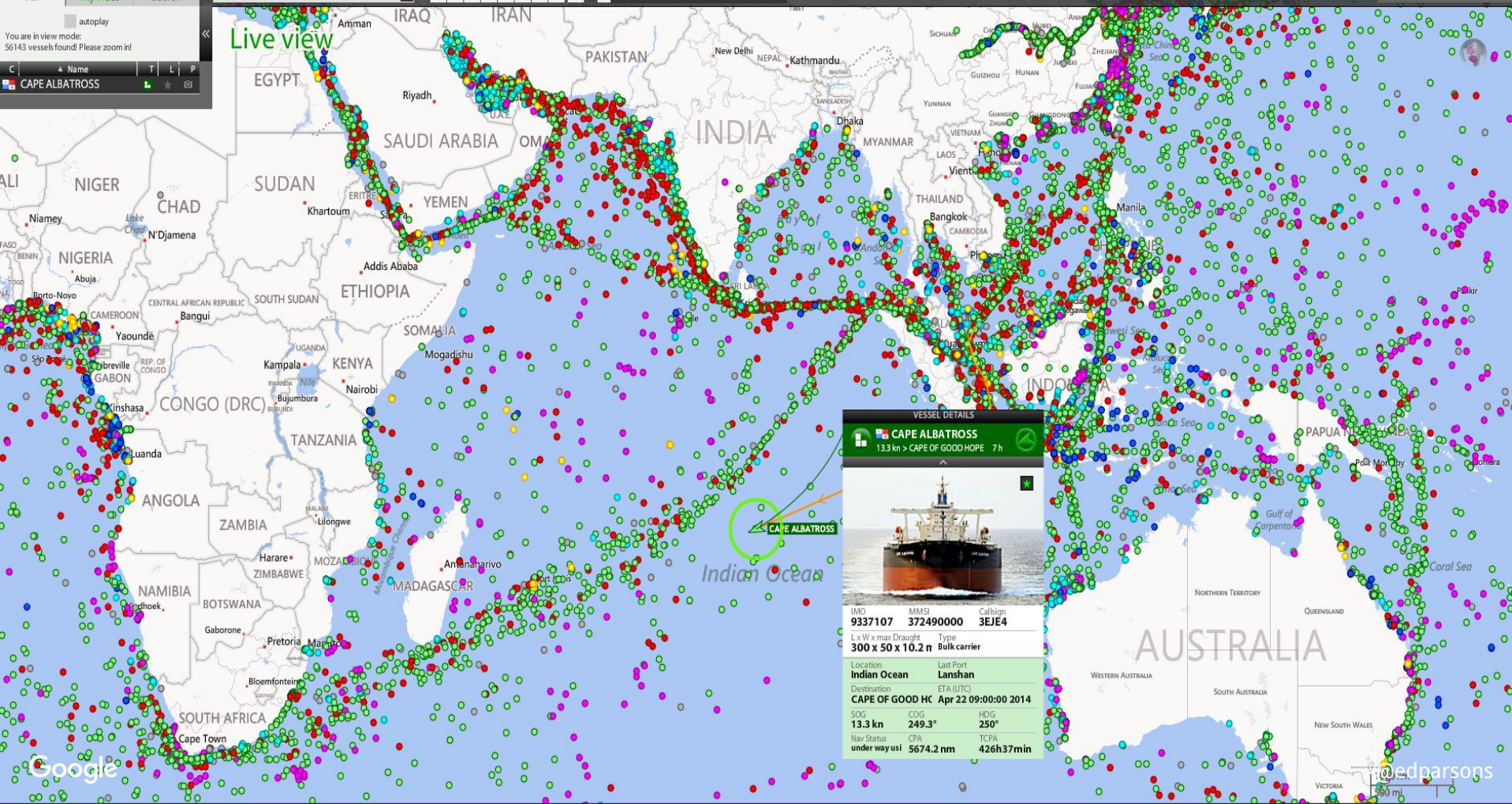


Live view

You are in view mode:
56143 vessels found! Please zoom in!

C ▲ Name T L P

CAPE ALBATROSS



VESSEL DETAILS

CAPE ALBATROSS
13.3 kn > CAPE OF GOOD HOPE 7 h



IMO 9337107 MMSI 372490000 Callsign 3EJE4

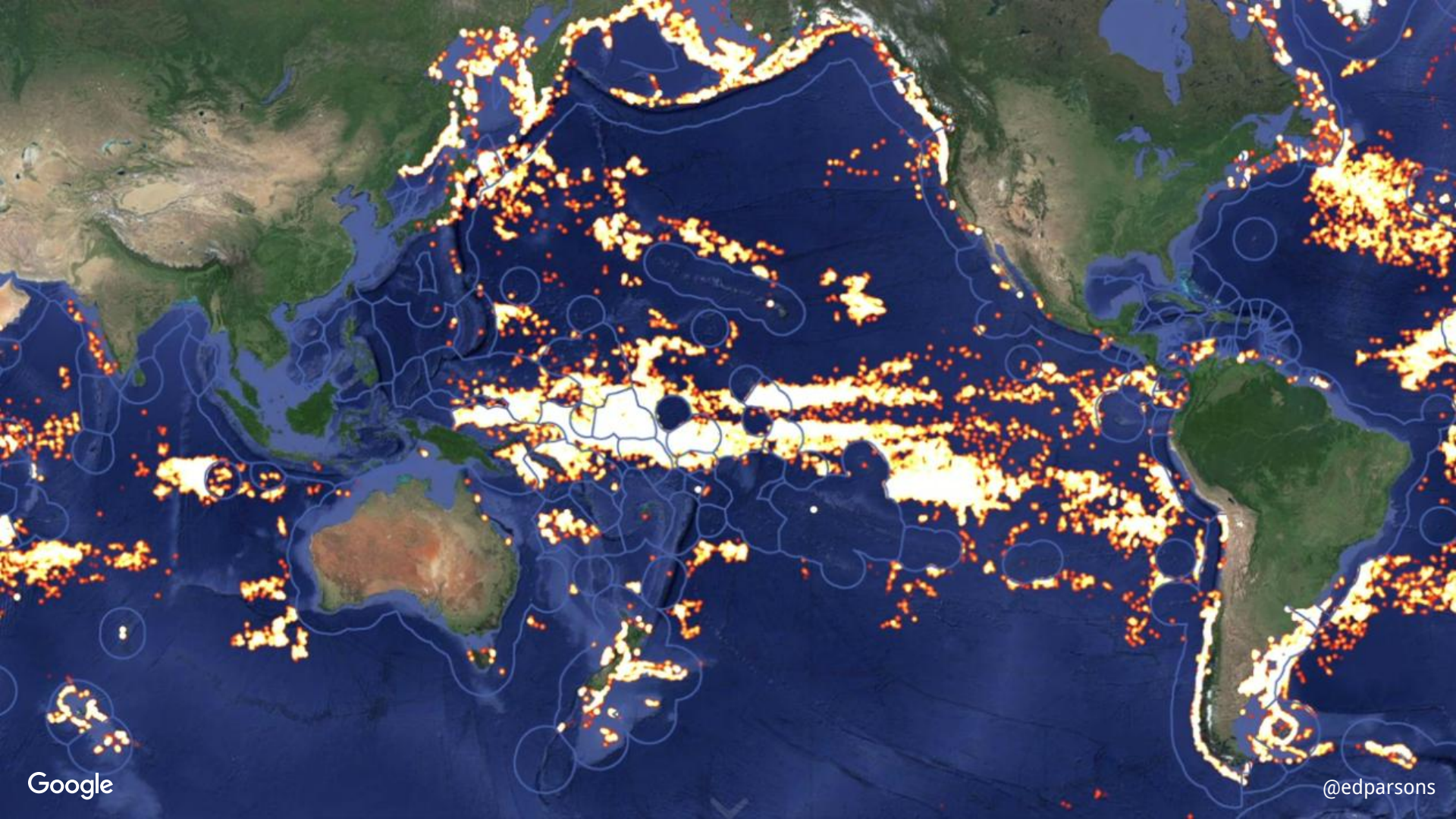
L x W x max Draught Type
300 x 50 x 10.2 m Bulk carrier

Location	Last Port
Indian Ocean	Lanshan

Destination	ETA (UTC)
CAPE OF GOOD HOPE	Apr 22 09:00:00 2014

SOG	COG	HDG
13.3 kn	249.3°	250°

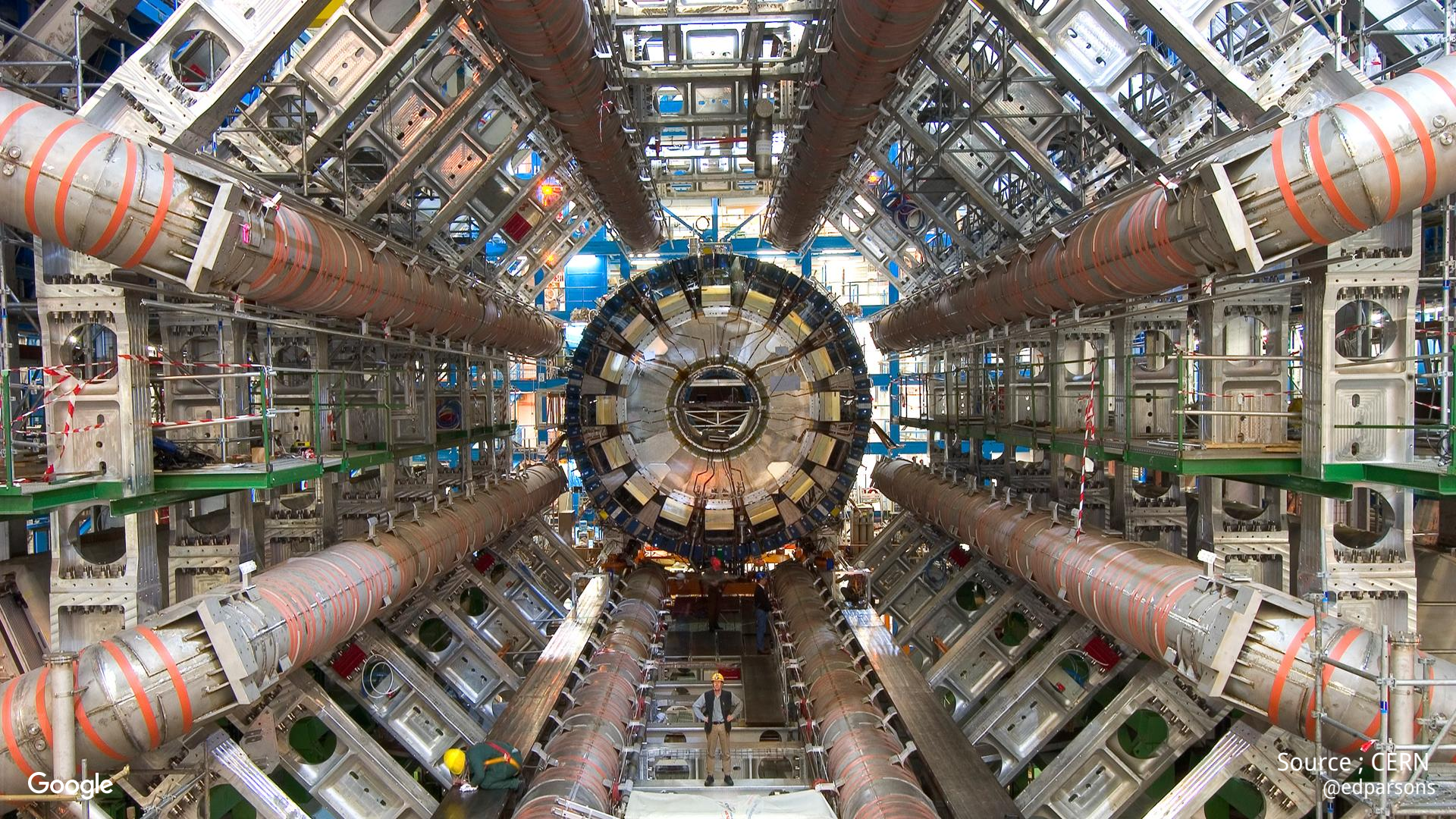
Nav Status	CPA	TCPA
under way usi	5674.2 nm	426h37min



Networked

- Devices /Sensors
- Data / Computing Resources
- Communities / Citizens

Virtual Research Infrastructures

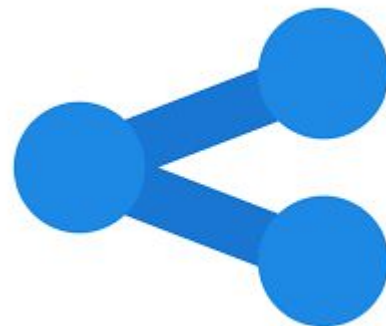


Global Research Networks ?



Virtual Research Infrastructure ?

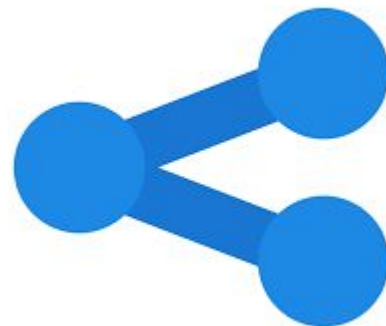
- Loosely coupled network centric approach
- Web Standards & Best Practice based
- Open Data / Data Commons
- Linked (Semantic) Data sharing
- Crowd sourcing / expert validation
- Multi-disciplinary
- Public / Private sector



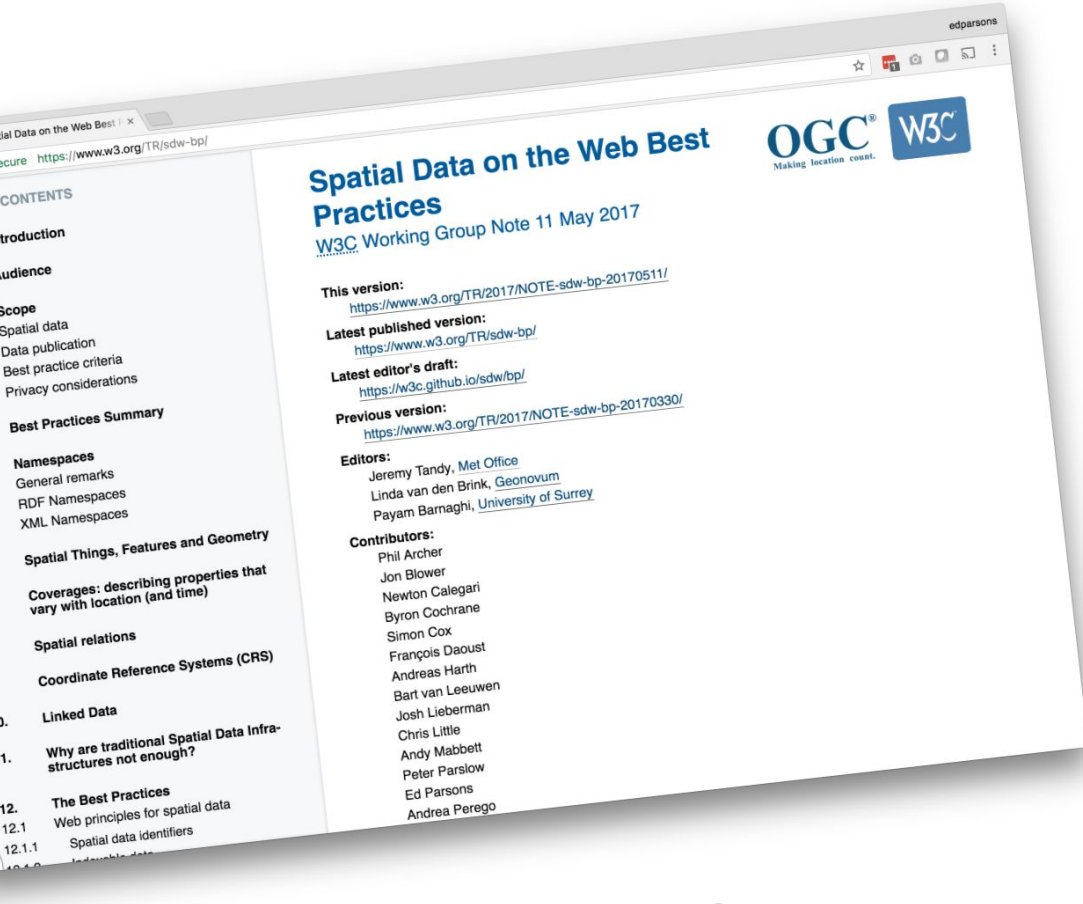
Data Sharing

Virtual Research Infrastructure ?

- Loosely coupled network centric approach
- **Web Standards & Best Practice based**
- Open Data / Data Commons
- Linked (Semantic) Data sharing
- Crowd sourcing / expert validation
- Multi-disciplinary
- Public / Private sector



Data Sharing



- Best Practice not theory
- No re-inventing the wheel
- Builds on W3C Data on the Web Best Practices
- Benefits vs. Effort

www.w3.org/TR/sdw-bp/

Best Practices Summary

[Best Practice 1](#): Use globally unique persistent HTTP URIs for Spatial Things

[Best Practice 2](#): Make your spatial data indexable by search engines

[Best Practice 3](#): Link resources together to create the Web of data

[Best Practice 4](#): Use spatial data encodings that match your target audience

[Best Practice 5](#): Provide geometries on the Web in a usable way

[Best Practice 6](#): Provide geometries at the right level of accuracy, precision, and size

[Best Practice 7](#): Choose coordinate reference systems to suit your user's applications

[Best Practice 8](#): State how coordinate values are encoded

[Best Practice 9](#): Describe relative positioning

[Best Practice 10](#): Use appropriate relation types to link Spatial Things

[Best Practice 11](#): Provide information on the changing nature of spatial things

[Best Practice 12](#): Expose spatial data through 'convenience APIs'

[Best Practice 13](#): Include spatial metadata in dataset metadata

[Best Practice 14](#): Describe the positional accuracy of spatial data

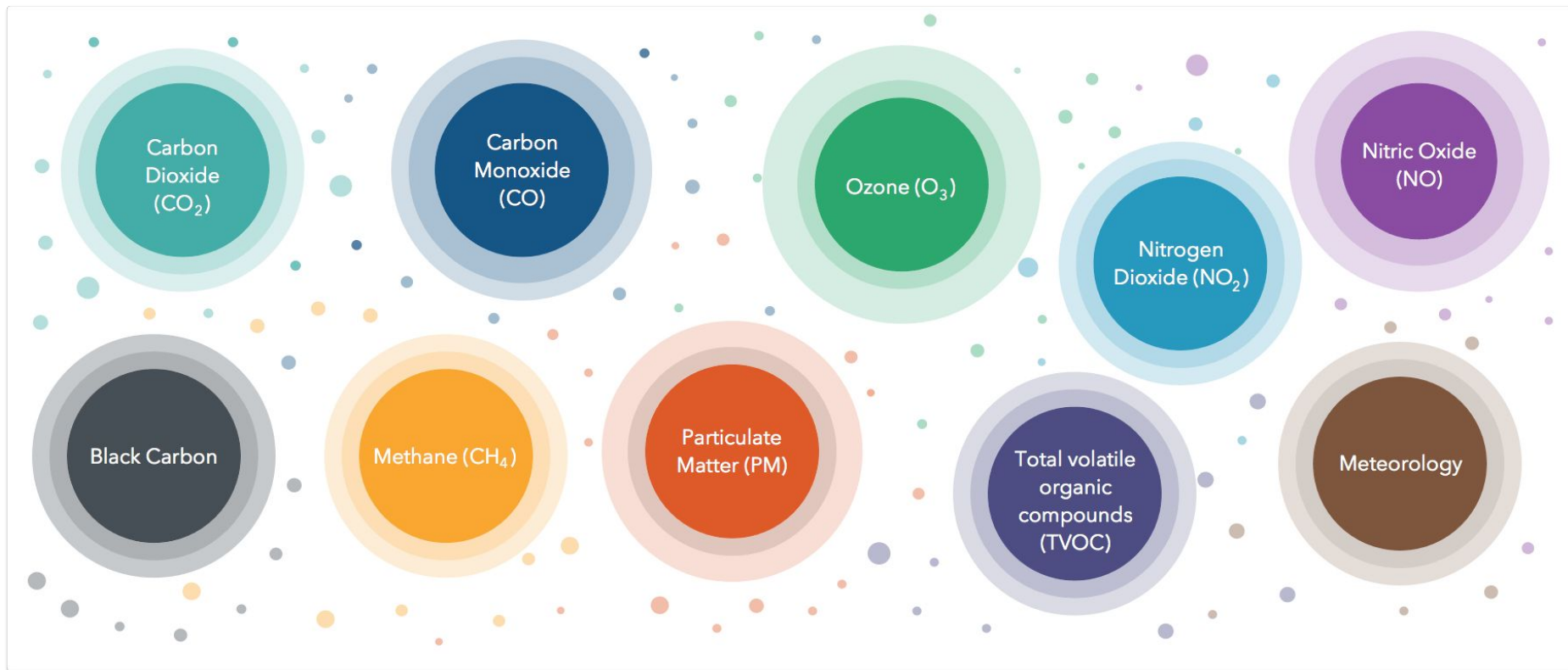


Opportunities

- High Resolution In Situ Sensing
- Cloud Accessible Global Datasets & Processing
- Multi-Disciplinary Collaboration

High Resolution In Situ Sensing





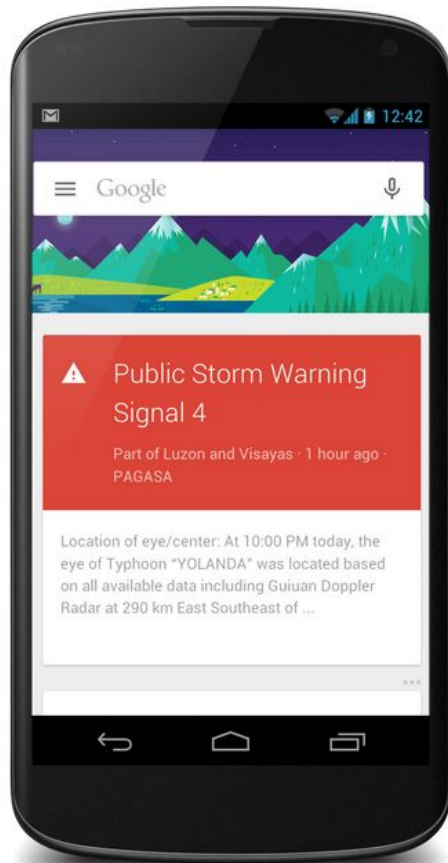


Air quality data from Google / Aclima

Google

Google Earth

@edparsons



Cloud Accessible Global Datasets & Processing



Forest Extent 2000
Forest Loss 2000-2012
Forest Gain 2000-2012
Both Loss and Gain

Google



@edparsons

Global Forest Change, 2000-2012 Source: Hansen, Potapov, Moore, Hancher, et al. (Science, 2013) Powered by Google Earth Engine



Bring the
algorithm to the
data...

Earth on AWS



ArcGIS Online

Google Earth Engine



```
1 var L8 = ee.ImageCollection("LANDSAT/LC8_L1T")
2   .filterDate("2015-01-01", "2016-01-01")
3   .select("B[0-9]*")
4
5 var image = ee.Algorithms.SimpleLandsatComposite(L8)
6 Map.addLayer(image, {min:0, max:60, bands: ["B4", "B3", "B2"]});
7
8
9
10
11
12
```



+

-

Layers

Map

Satellite



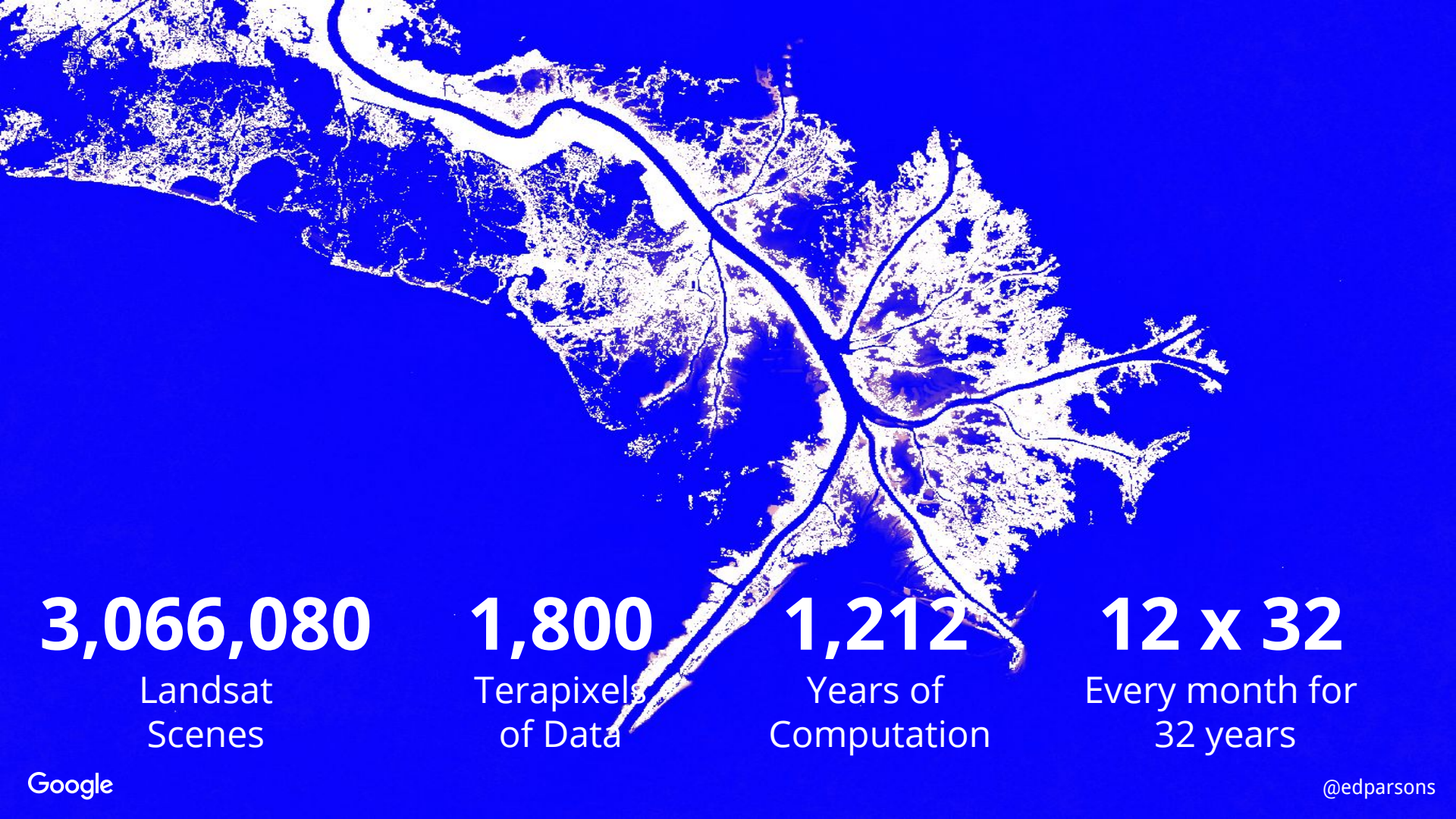
```
1 var L8 = ee.ImageCollection("LANDSAT/LC8_L1T")
2   .filterDate("2015-01-01", "2016-01-01")
3   .select("B[0-9]*")
4
5 var image = ee.Algorithms.SimpleLandsatComposite(L8)
6 var training = image.sampleRegions("users/gorelick/urban/dallas", null, 30);
7 var classifier = ee.Classifier.cart().train(training, "class")
8 var result = image.classify(classifier);
9
10 Map.addLayer(result, {min:0, max:1, palette: ["black", "red"]});
```



Layers

Map

Satellite



3,066,080

Landsat
Scenes

1,800

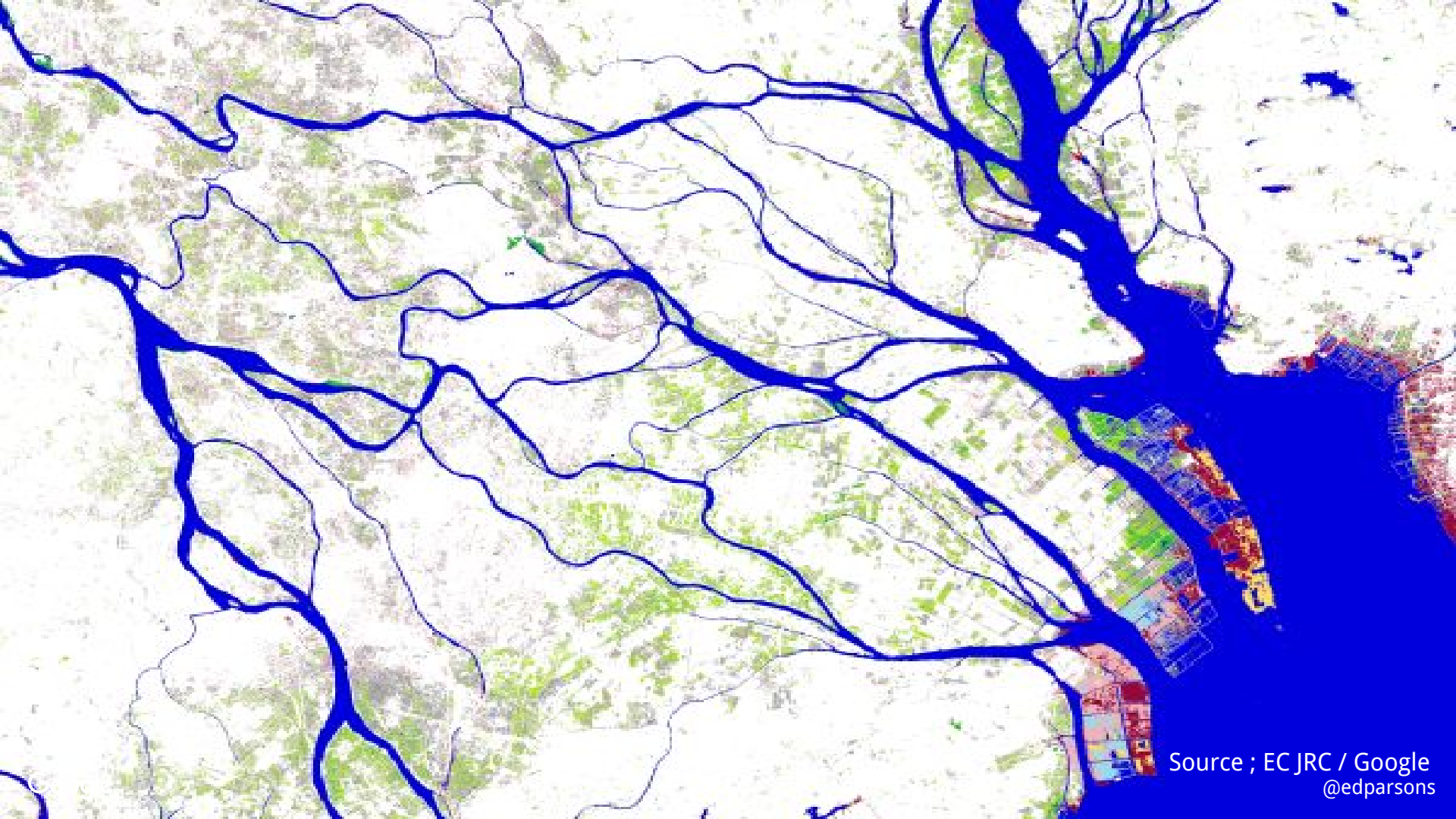
Terapixels
of Data

1,212

Years of
Computation

12 x 32

Every month for
32 years



Multi-Disciplinary Collaboration

A photograph of two men in a forest setting. The man on the left is wearing a plaid shirt and the man on the right is wearing a blue jacket. They are both smiling and holding a custom-built electronic device. The device has a green circuit board, a small LCD screen, and four AA batteries. They are standing behind a large, mossy tree trunk. The background is filled with green foliage and brown leaves.

“I like to listen. I have learned a great deal from listening carefully. Most people never listen.”

Ernest Hemingway



Search Google Maps



George
Denton Park &
Polhill Reserve

ZEALANDIA
Ecosanctuary

Raiwa Rd

Messines Rd

Tiro St

Dunelm St

Plymouth St

Mess



Google



2D

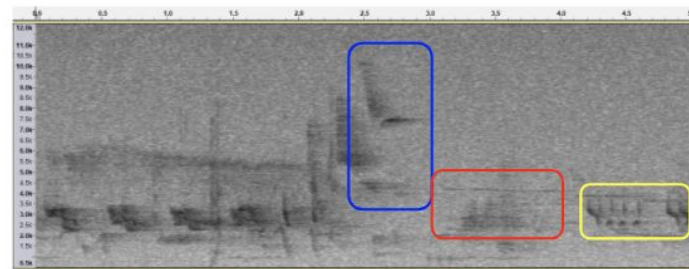
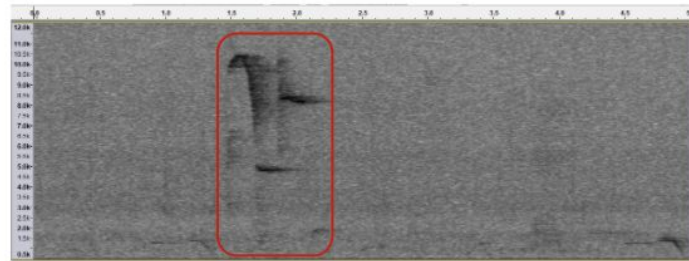


@edparsons



Here come the machines

- Spectrograms taken at 50 sites over 3 years processed individually by a deep convolutional neural network
- Open Source Tensor Flow tools allowed processing using massively parallel computing environments including GPU's
- Bird calls recognised at each site allowed habitats to be accurately mapped



Some research challenges

- Veracity of cloud based information
- Data Protection Concerns
- Network Accessibility
- Societal nudge factors
- Academic Research Focus ?



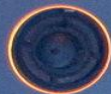
A Final Thought..







PFD/ND
XFR



ND



OFF BRT

CONSOLE/FLOOR

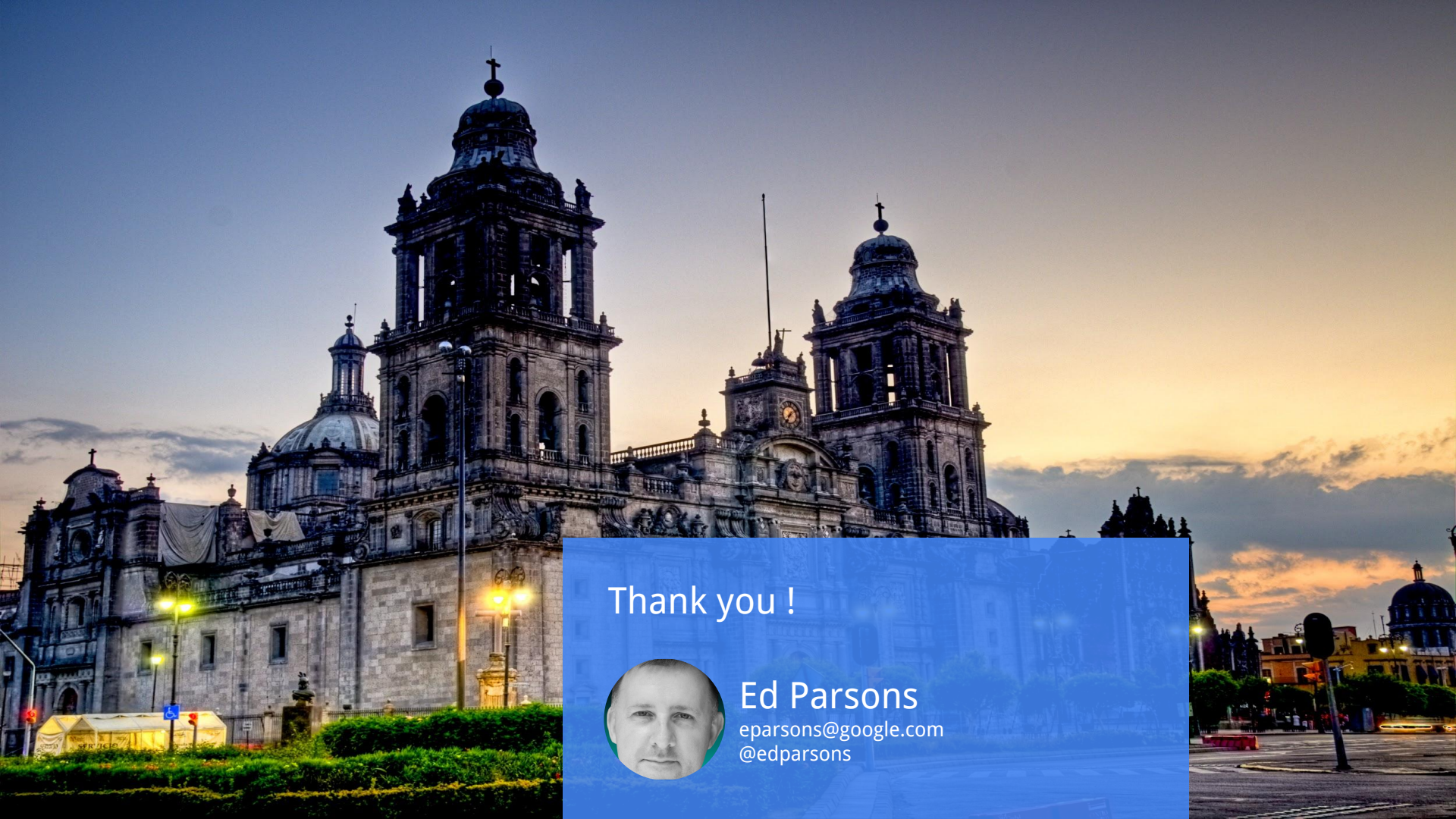
BRT



DIM

OFF





Thank you !



Ed Parsons

eparsons@google.com

[@edparsons](https://twitter.com/edparsons)